

SDMS Doc ID 2015036

PERCHLORATE

U.S. EPA, Region 9



What is Perchlorate - Chemistry & Uses
Brief History of Environmental Concern
Toxicity
Occurrence
Regulatory Status
Treatment Technologies
Ecology and Agriculture



Perchlorate CHEMISTRY



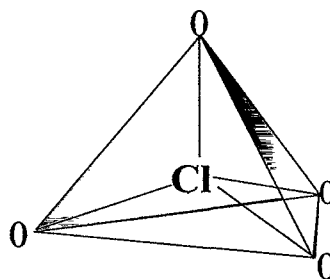
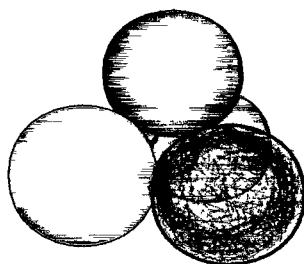
Dissolves and Moves Like Salt in Water

Highly Soluble, Mobile, Stable

Hard to Treat by Usual Methods

**Hard to Detect Below 400 ppb,
until March 1997 Method to 4 ppb**

PERCHLORATE



USES of PERCHLORATE

90% Manufactured for Solid Rocket Fuel

Explosives

Fireworks, Flares and Smoke Markers

Reported in Nitrate Fertilizer from Chile



PERCHLORATE HISTORY Before 1997

**1980s - Aware of Perchlorate Use at
CA and NV Superfund sites**

**1985-86 - San Gabriel Valley Superfund Site
- Tested in Groundwater, but Data Invalid**

**1990s - Rancho Cordova (Aerojet)
- Discovered at > 1000 ppb in Groundwater**



PERCHLORATE HISTORY Before 1997

**1992 and 1995 - Provisional Reference Dose
(4-18 ppb)**

1997 - Analytical Breakthrough to 4 ppb

**1997 and 1998 – Region 9 Alerts EPA
HQ, Regions, and States**



Perchlorate TOXICOLOGY Before 1997

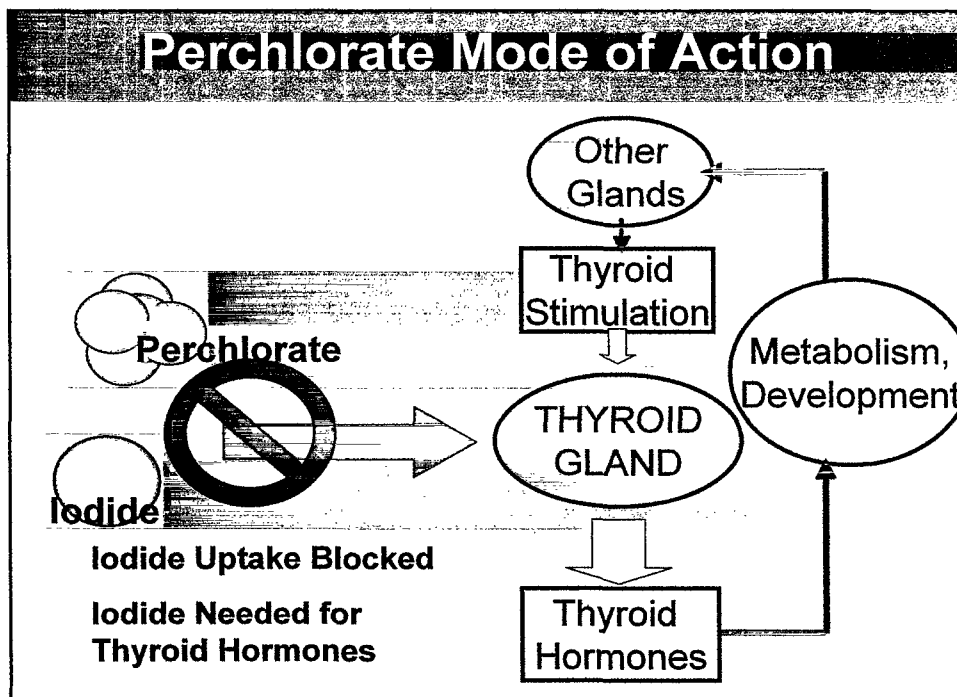
**Blocks Iodide Uptake into Thyroid,
Disrupts Production of Hormones**

Human Drug Tests in 1950's

**EPA Provisional Reference Dose 1992/95
Range of 4 to 18 ppb in Drinking Water**

**Before 1998, No Data on Children's Health
or Chronic Effects**

1000x Uncertainty Factors



What is a REFERENCE DOSE (RfD)?



Science Based Only, Not a Regulation

DOSE is mg chemical per kg body wt. / day

$$\text{RfD} = \frac{\text{No or Lowest Observed Effect Level}}{\text{Uncertainty Factors}}$$

Toxicology EPA Interpretations From January 2002 Draft



Animal Studies Used to Measure Impact

Effects on Brain Development in Rat Pups

Draft Reference Dose of 0.00003 mg/kg-day

Adult Drinking Water Equivalent = 1 ppb

Only 300x Uncertainty Factors

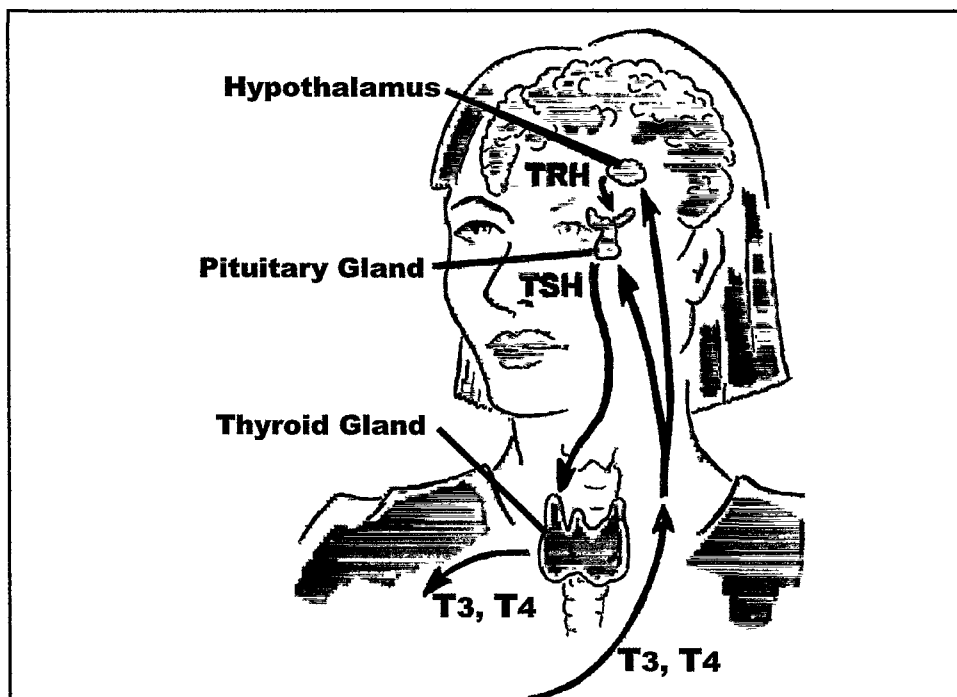
EPA 2002 Draft
TOXICITY SCHEDULE

January – June 2002 External Peer Review

Expected Final Draft in Spring 2003

2003 National Academy of Sciences Review

**2004 (approx.) Revised Reference Dose on
Integrated Risk Information System (IRIS)**



PERCHLORATE SHIPMENTS



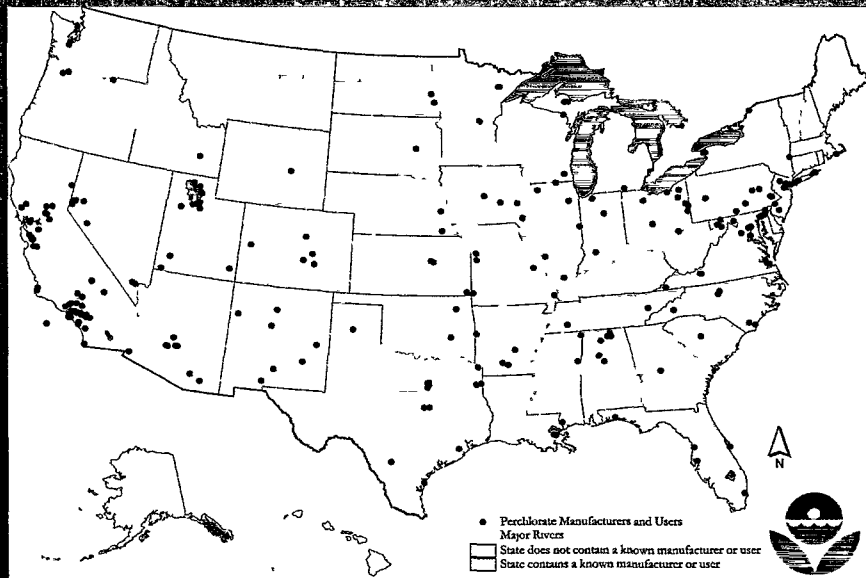
**Manufacturer's Information
from Region 9 Superfund Requests**

About 240 facilities

40+ States

Most Information in Last 20 Years

PERCHLORATE MANUFACTURERS and USERS



APRIL, 2003

PERCHLORATE in the ENVIRONMENT



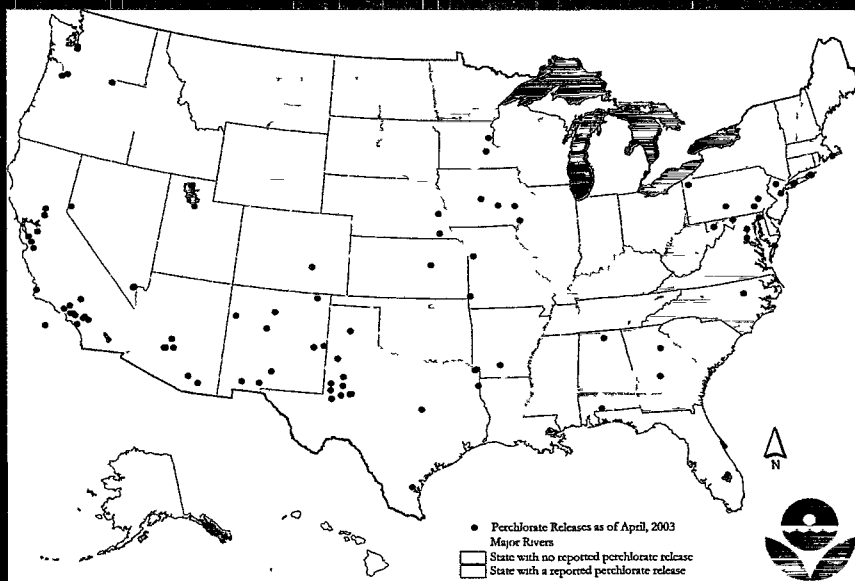
RELEASES REPORTED IN 29 STATES

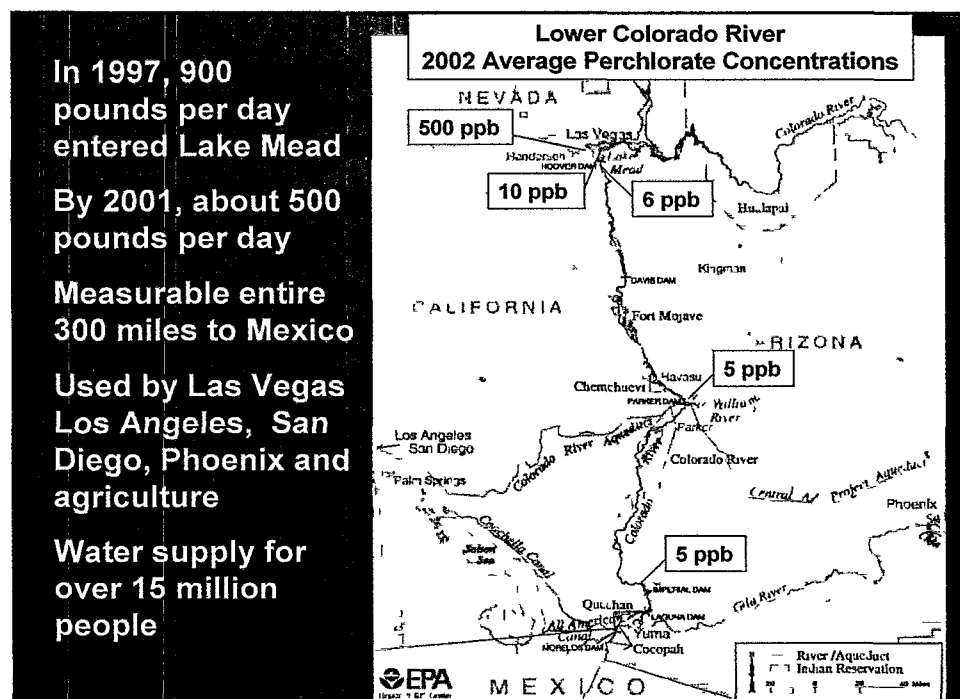
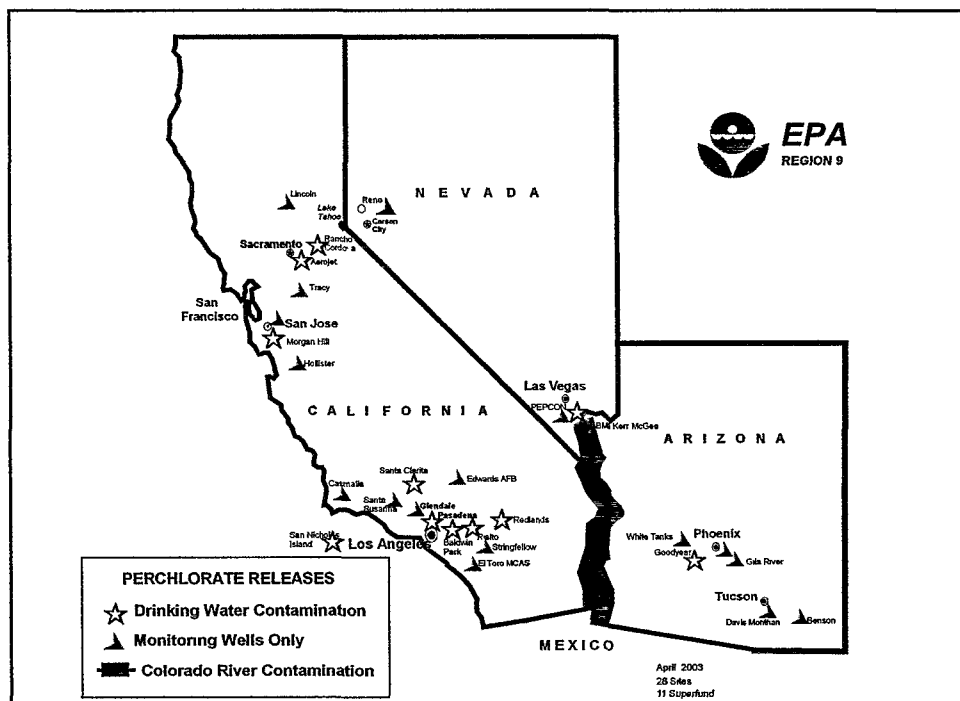
AL, AZ, AR, CO, GA, IA, KS, MD, MO, MA, MN, NE, NV, NJ, NM, NY, NC, OR, PA, TX, UT, VA, WA, WV, also FL, LA, MS, RI since April

CALIFORNIA

Over 5600 Water Supply Wells Tested
Detected in 319 sources, 5.6 %

PERCHLORATE RELEASES – April, 2003





In 1997, 900 pounds per day entered Lake Mead

By 2001, about 500 pounds per day

Measurable entire 300 miles to Mexico

Used by Las Vegas
Los Angeles, San Diego, Phoenix and agriculture

Water supply for over 15 million people

Regulatory Authority



**EPA has exercised authority under
SDWA, RCRA, CERCLA**

Standards are site-specific, no federal standard

**Contaminant Candidate List to consider
possible Drinking Water Standard (MCL)**

EPA's MCL Process takes several years (2008?)

Possible EPA Health Advisory (Office of Water)

States and Tribes are developing Standards

State "Advisories"



California... 4 ppb

New York... 5 ppb and 18 ppb

Texas... 4 ppb, 7 ppb or 10 ppb

Arizona... 14 ppb

Massachusetts... 1 ppb

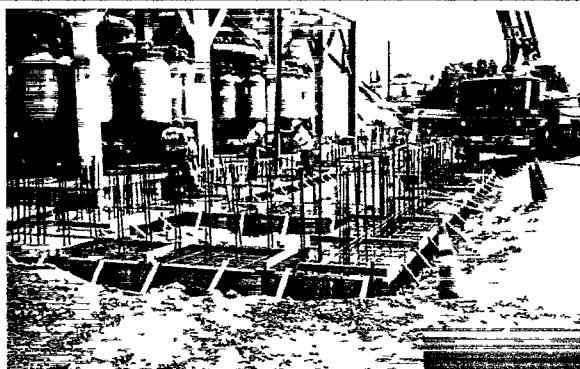
Maryland... 1 ppb

New Mexico... 1 ppb

Nevada... 18 ppb

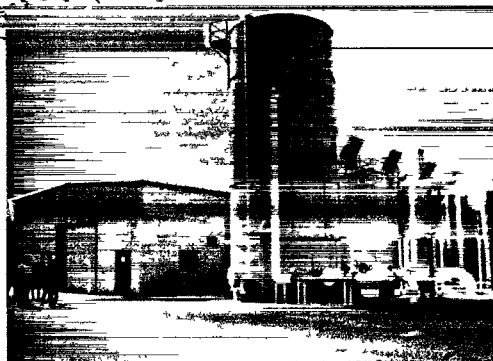
Perchlorate Treatment

**Treatment Systems are Operating
Full Scale, Commercially Available
Ion Exchange – Regenerate or Dispose
Various Types of Biological Systems
Reverse Osmosis for Small Systems**



**Ion Exchange for
Groundwater
Treatment,
San Gabriel
Superfund Site
Baldwin Park, CA**

**Fluidized Bed
Bioreactors at Aerojet
Superfund Site
Rancho Cordova, CA**



Ecological Risks



**Direct Effects on Fish/Animals observed
at High Concentrations**

Unknown Effects at Lower Concentrations

Agriculture Uses Colorado River and GW

- Lettuce near Yuma
- Many Crops in Imperial Valley/Coachella Valley
- Citrus in Riverside



Perchlorate INFORMATION



U.S EPA Technology Innovation Office
www.clu-in.org/perchlorate

American Water Works Assn Research
www.awwarf.com/research/spperch.asp



